SHORT COMMUNICATION

The hidden history of recurrent arteriovenous haemodialysis access procedures

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INTRODUCTION

Haemodialysis (HD) is now widely used as a viable method to the therapy of End Stage Kidney Disease (ESKD) to advances in vascular surgery procedures. External constant flow Arteriovenous (AV) devices, such as the Quinton-Scribner shunt, have improved the reliability and repeatability of circulation access, but thrombosis and infection have limited their longevity, and the treatment permanently damaged major arteries and veins. The surgery that allows for long-term HD by creating an endogenous AV fistula is simple, completely subcutaneous, and did not interrupt artery supply to the hand. Patients who were not candidates for a fistula could now acquire a durable subcutaneous access with the use of AV grafts. The introduction of expanded Polytetrafluoroethylene (ePTFE) vascular conduits and biologically processed bovine carotid arteries in the 1970s dramatically increased AV access for individuals whose natural veins were not suitable for an AV fistula. Polyurethane self-sealing materials in AV grafts, as well as a hybrid graft with a catheter venous outflow device, have increased vascular access choices for patients with poor native vasculature in recent years. The arm is definitely the preferable location for fistulas or grafts; although, in some cases, the leg may be used instead. To protect more proximal veins for future HD accesses, it is almost always preferable to choose the most distant vein possible for an AV shunt. In patients with advanced Chronic Kidney Disease (CKD) who will likely require HD in the future, nephrologists should advocate for a "preserve the vein" initiative. In individuals who may require HD later, such a strategy may involve avoiding the use of a Peripherally Inserted Central Catheter (PICC line). PICC lines are frequently inserted into the central venous system from the antecubital vein, passing through the cephalic or basilica vein. These tubes, which are used to allow drug infusions or blood draws, have a higher risk of infection.

Synthetic graft material has not historically provided the same long-term success as a Brescia-Cimino or other autogenous AV fistula in terms of function duration and complication rate. However, recent research using more recent patient cohorts suggests that the difference in major clinical outcomes between AV fistulas and AV grafts may not be as large as originally thought. 106,107 Nephrologists should advocate for a catheter-last approach to HD access rather than a fistula-first approach for all patients [1]

DISCUSSION

The risk of significant infection, patients receiving continuous haemodialysis has been advised to avoid tunnelled haemodialysis catheters in favour of arteriovenous fistulas (AVFs) or arteriovenous grafts (AVGs). The cost of interventional procedures after surgical installation of AVFs and AVGs is less well understood. The difficulty of starting patients on AVFs is exacerbated by a primary failure rate of 30%-70 % and a primary patency rate of 40%-70 % after one year [1]. To assess the procedural burden incurred by incident haemodialysis patients during the maturation and maintenance phases of their AVFs/AVGs, researchers used the US Renal Data System. The maturation phase was defined as the time between AVF/AVG placement and first use, whereas the maintenance phase was defined as the time between first use and the end of follow-up [2]. They discovered that 24.4 percent of patients in the AVF group required a procedural intervention during the maturation period, and 39.6 percent required intervention during the maintenance phase, based on administrative data. The comparable results in the AVG group were 18.4% and 57.7%, respectively. The total procedural load for AVFs and AVGs is similar, but the time distribution changes, with AVFs requiring more maturation procedures and AVGs requiring fewer [3].

Maturation of an AVF involves a response of endothelial cells to changes in blood flow, requiring adequate cardiac output, adequate arterial pressure, a suitable arterial vessel, and an unrestricted venous vessel [4,5]. A decade and a half ago, identified coronary artery disease (a comorbidity impacting adequate inflow) and peripheral vascular disease (a comorbidity impacting adequate outflow) as predictors of inadequate fistula maturation. Additional epidemiologic risk factors for failed maturation included age ≥ 65 years, non-White race, and female sex. Obesity and diabetes are additional factors that may influence maturation and patency of AVFs [6]. Surgeon experience is an important contributor to successful maturation of AVFs and cannot be assumed to be homogeneous in a national population [7].

Long before the requirement for haemodialysis, efforts to achieve satisfactory maturation and function of an arteriovenous access begin. Patient demographics, comorbidities, anatomical considerations, and process factors all influence when and what type of haemodialysis access should be placed [6]. Preoperative ultrasonography or other imaging modalities, when used in patients at risk for primary or secondary access failure, reduce the risk of access formation with poor target vasculature, which could result in a series of interventional treatments to maintain patency [7]. To allow for a functional access during haemodialysis start, nephrologists and surgeons should follow national guidance for access placement, giving specific attention to the drop in estimated glomerular filtration rate. Arteriovenous access development should ideally be done or supervised by a skilled surgeon. The present procedure burden for patients on haemodialysis maintenance Nephrologists are at a crossroads with AVFs that will very certainly require several repeat interventions to mature [8] in order to avoid tunnelled dialysis catheters, which put patients at risk for life-threatening infections. With the possibility of a tunnelled catheter or repeat access creation surgery, interventional nephrologists and radiologists execute many operations to re-establish patency in their patients. The study of novel investigative candidates has resulted as a result of this procedural load.

A variety of new therapeutics also showed promise in promoting arteriovenous access maturation and maintaining patency [9]. In a small number of patients, two procedures for creating percutaneous endovascular AVFs have showed significant success rates (87% to 88%) [10]. A retrospective comparison of AVFs and surgically produced AVFs revealed that AVFs had superior maturation but similar patency and percutaneous procedure rates. By reducing turbulence at the arteriovenous anastomosis during surgery, internal and external devices help to promote laminar flow. These gadgets have only been tried on a few patients, and the findings are still ambiguous [11]. Repeated angioplasty is required for recurrent stenosis, which is the most common cause of dysfunction in mature AVFs. In individuals with mature dysfunctional AVFs, a recent randomised controlled trial revealed a 6 months reduction in stenosis recurrence when compared to normal balloon angioplasty; paclitaxel-coated drug-eluting balloons have a lower procedural burden [12]. Bioengineered vessels and grafts, such as the human

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acellular vessel (Haemocyte Inc) and star graft (Heal Ionics), are being tested in patients with AVGs in the hopes of reducing the number of required maintenance treatments [10].

The high procedure load for haemodialysis patients, a problem that professional interventional nephrologists/radiologists and vascular surgeons are well aware of. From the onset of advanced chronic renal disease to the start of haemodialysis, the solution will necessitate close attention to each phase. Identifying the best dialysis access based on patient characteristics and anatomy, addressing institutional hurdles to timely referral and installation of arteriovenous access, and developing innovative therapeutics to enhance patency and maturation will all help to reduce the procedural burden. In a nutshell, success will be determined by meticulous attention to detail.

CONCLUSION

Interventions for both AVFs and AVGs were fairly common during maturation. AVFs have fewer maintenance interventional requirements once they had matured. There were spatial differences in AVF intervention rates during the maturation and maintenance periods, which require further investigation. Our findings support the hypothesis that HD vascular access type at the time of beginning of renal replacement therapy is an important modulator of the link between dialysis modality and survival in incident dialysis patients. Our findings highlight the importance of an early referral programme for ESRD patients, ensuring that those who choose HD have a functioning AVF and those who choose PD receive a Tenckhoff catheter in a timely manner. We believe that such a policy would reduce dialysis morbidity and mortality.

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